Space Weather Technical Forecast

Issued on Thursday, 25 August 2022 at 12:11 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Active fluence likely persisting for another day. Chance of Moderate flares (R1-R2 Radio blackouts) throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity is Low with several recent C-class flares observed. There are six sunspot regions on the visible disc, three of which are unnumbered. AR3085 appears to be stable and no longer developing. AR3086 also appears stable and the intermediate spots continue to diminish. AR3087 and the new region in the northeast quadrant are both simple uni-polar spots. The new region in the SW quadrant has grown significantly and is north-south orientated (unusual). It is now beta-gamma in magnetic configuration, but there is evidence its rapid appearance is pushing on the surrounding corona and causing it to destabilise in places, so close attention for non-flare CMEs will be paid. A third new region which recently emerged over the southeastern limb is developing rapidly and this appears to be the source of most of the recent C-class flares. Currently, no Earth-directed CMEs were observed in the last 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR at L1, followed an erratic slow decline, in the last 24 hours, reducing from 420 to 350km/s. There was an erroneous period of 500km/s showing up on DSCOVR between 1600-2000UTC which can be ignored as it didn't show on ACE, likely down to a low solar wind density period (known error). Otherwise, the density was generally average or below average. The total magnetic field strength (IMF) Bt, was weak, between 5-7nT, with small fluctuations in Bz between +5 and -5nT. The phi angle was negative (towards the Sun). Geomagnetic activity was Quiet (Kp 0-2).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV), as measured by GOES-16, was at Background levels. The high energy electron flux (greater than 2 MeV) remained at High levels, with a peak of 3160 pfu at 24/0010 UTC and on a slow declining trend. The 24-hour integrated electron fluence remained above the Active threshold (1e8 integrated pfu) throughout the period, also now showing a slow declining trend. A value of 1.97e8 total pfu was observed at 24/2100 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to be Very Low or Low through this period based on the current configuration of sunspots, with a chance (30%) of an isolated M-class flare,

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs currently feature in this forecast. Solar winds at slow-ambient levels will probably change little for the next 24 hours with geomagnetic activity remaining Quiet (Kp0-1). A slight enhancement is probable at the end of day 2 (26th) and into day 3 (27th) under the influence of CH18/+ but its impact on geomagnetic activity should be small, with perhaps isolated Active intervals (Kp4).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is

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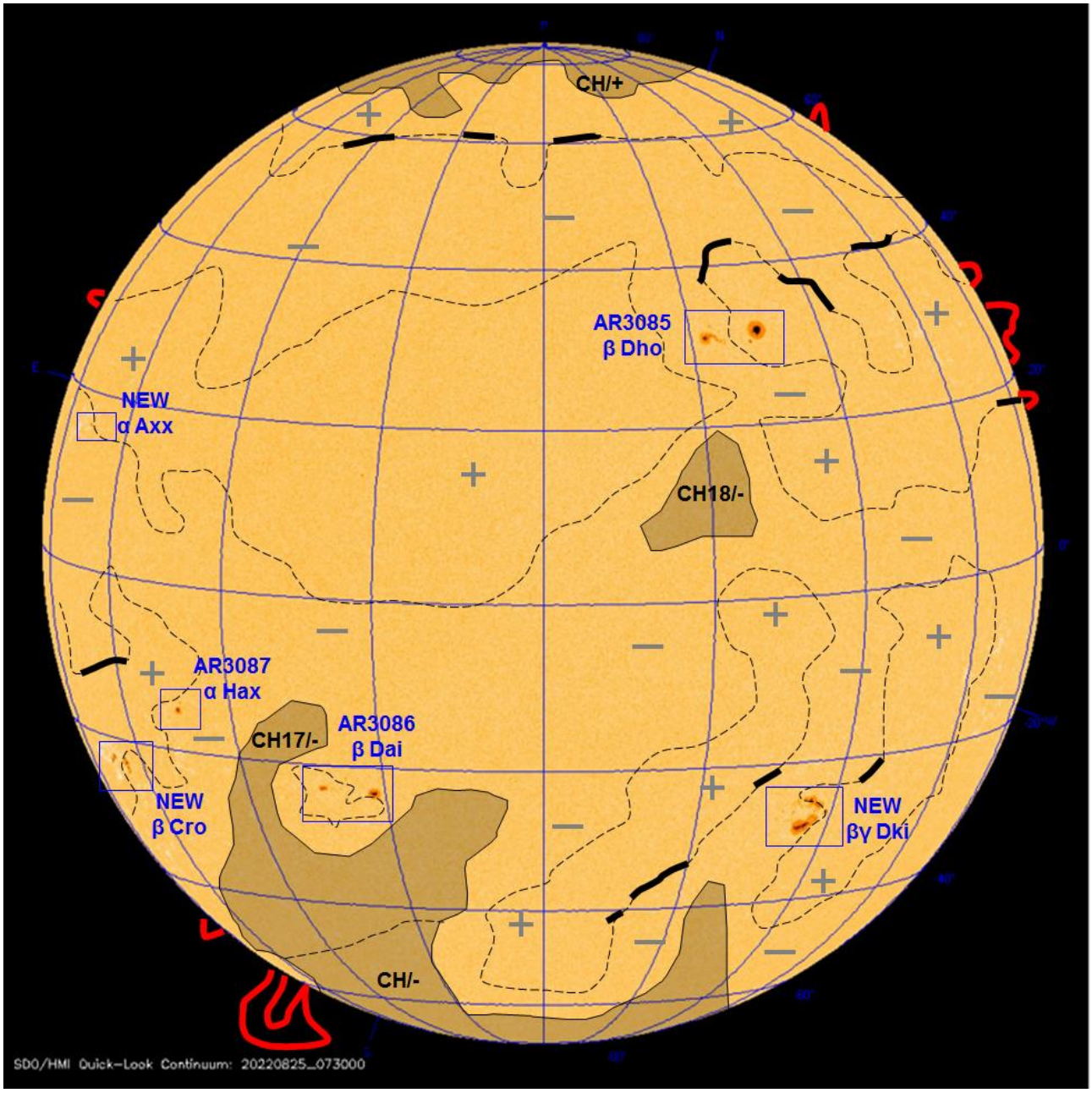
forecast to remain at Background levels. The high energy electron flux (greater than 2 MeV) is currently at High levels but is expected to see a decrease in peak values to finally drop to background and moderate levels. Consequently the associated active 24-hour fluence is expected to continue to show a decreasing trend, likely dropping back below the 1e8 threshold by the end of the 25th (Day 1) or early 26th (day 2) based on the current trend.

Figure 1. Solar Analysis Valid 0800UTC, 25 August 2022.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

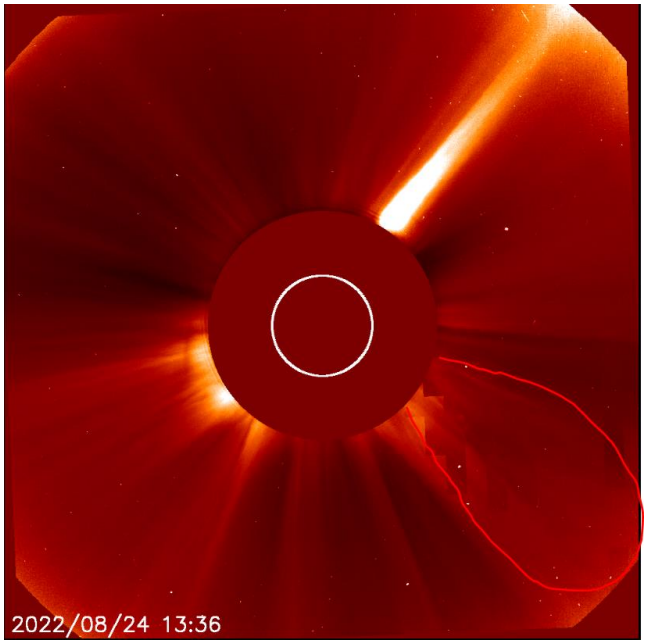
No Earth-directed CMEs currently feature in this forecast. Solar winds are currently at slow-ambient levels, around 350km/s, with no significant enhancements expected and geomagnetic activity is forecast to be Quiet (Kp0-2). The next coronal hole is CH18/+ and is expected to become geoeffective at the end of day 2 and into day 3 (26th and 27th). It is a recurring feature, however it achieved very little in terms of speed and geomagnetic activity on the last rotation and despite being slightly larger this time round, its impact is expected to remain small, so isolated Unsettled or Active intervals possible (Kp3-4).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	5	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

Figure 2: Recent LASCO-C2 imagery from SOHO depicting far-sided CME that departed the sun early on 24 August.



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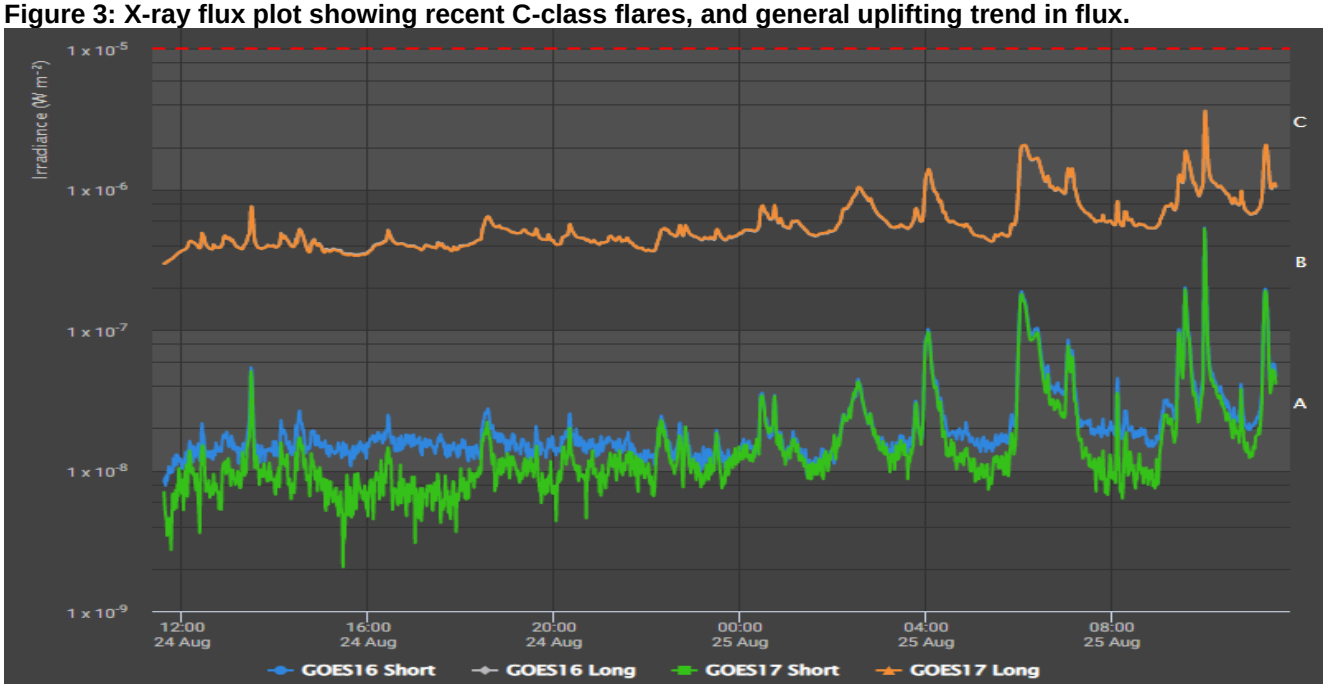
Radio Blackouts - X-Ray Flares:
Solar activity is Low with several recent low level C-class flares, the largest so far C3.6 at 25/1001UTC. There is a growing chance of further C-flares and a chance of M-class flares, particularly since a new region rapidly developed in the southwest quadrant, as well as a new region in the far southeast that has recently rotated across the limb from the far-side of the disc, and it is this new region that appears to be responsible for the majority of these C-class flares so far.
Of the six sunspot regions currently on the visible disc, three are three numbered and three unnumbered. This aforementioned unnumbered region in the southeast (S24E71) continues to grow and develop. The second largest region is AR3085, and it remains simple and is no longer growing. AR3086 has also seen most of its intermediate spots vanish and is simplifying. AR3087 and the new region in the northeast quadrant both remain small and simple with unipolar characteristics. Finally the third new and unnumbered sunspot region which has quickly emerged in the southwest quadrant is vertically aligned, and appears to be becoming more magnetically complex with a Beta-Gamma arrangement and multiple merged bipolar spots.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	30	30	40	30
Very Active	R3 to R5 X Class	No	1	1	5	1

Figure 3: X-ray flux plot showing recent C-class flares, and general uplifting trend in flux.



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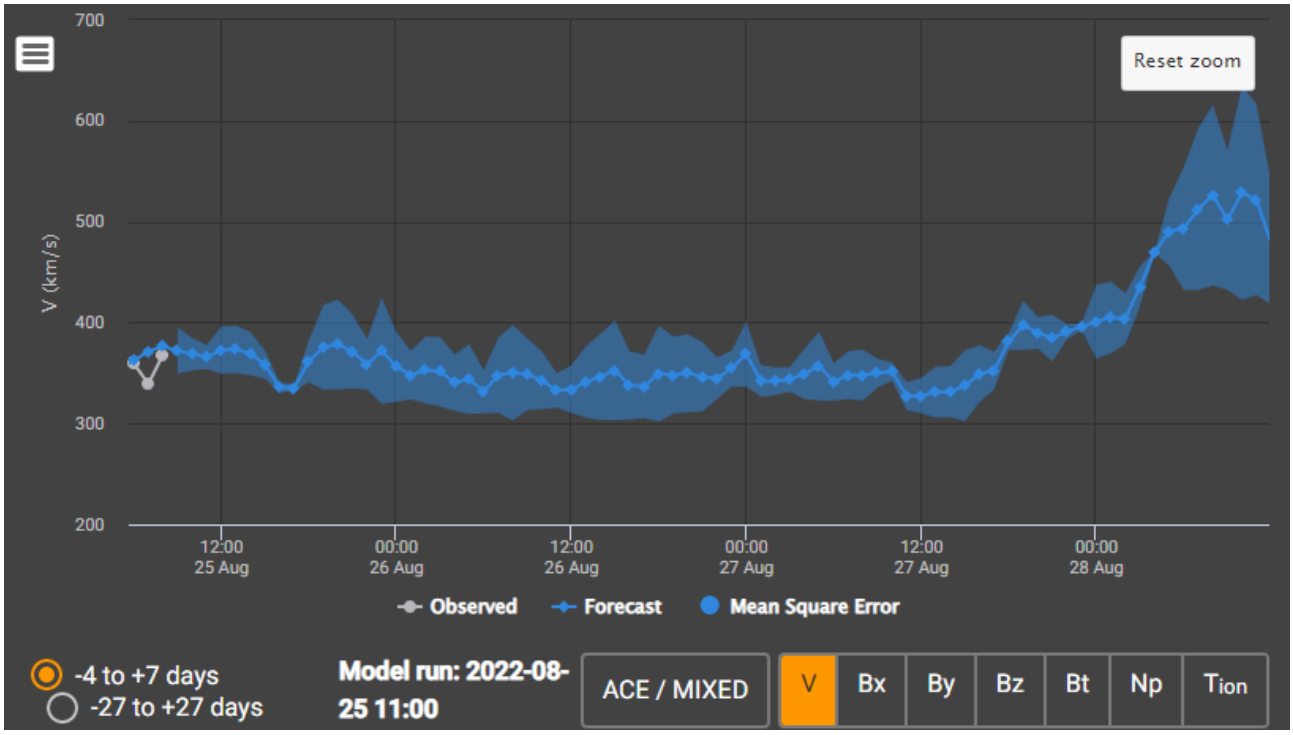
Solar Radiation Storms - (High Energy Protons):
The high energy proton flux (greater than 10 MeV) is currently at Background levels and is expected to remain at this level through the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: Met Office Solar Winds Prediction Model (SWPM) with next enhancement in solar winds probably 24 hours too delayed, with it more likely to start late on day 2 (26th)



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High Energy Electrons Event (≥ 2MeV):
The high energy (greater than 2 MeV) electron flux as measured by GOES-16 is currently High after recent coronal hole enhancements. With no further enhancements expected which could potentially drop the electron counts, only a gradual reduction in peak values is likely. The electron flux should eventually drop to background and moderate levels perhaps by day 2 (26th) but probably not until day 3 (27th) although confidence is low with regards to timings.
The associated fluence is expected to reflect this decreasing trend, likely remaining Active (above 1e8 pfu) into day 2 (26th), before coming back below threshold thereafter. While the trend of the fluence as depicted by Met Office REFM output is accepted, it is considered an under-estimate at this stage as it shows a forecast of below 1e8 fluence by 25/0900Z, which is probably too early.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	Yes	100	70	20	10
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: High energy electron flux and Met Office REFM output.

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